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ATTORNEY'S DOCKET NUMBER: LLE-004.01

# TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U S APPLICATION NO (If known, see 37 CFR 1 5): 09/509732

| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED |
|---|---|---|
| PCT/IL98/00453 | (17.09.98) 17 September 1998 | (01.10.97) 01 October 1997 |

TITLE OF INVENTION: **WATER TREATMENT METHOD AND DEVICE**

APPLICANT(S) FOR DO/EO/US
**ITZHAK, David**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. (X) This is the FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ( ) This a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. (X) This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. (X) A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. (X ) A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. (X) is transmitted herewith (required only if not transmitted by the International Bureau).
   b. (X) has been transmitted by the International Bureau.
   c. ( ) is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ( ) A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. (X ) Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. (X) are transmitted herewith (required only if not transmitted by the International Bureau).
   b. (X) has been transmitted by the International Bureau.
   c. ( ) have not been made; however, the time limit for making such amendments has NOT expired.
   d. ( ) have not been made and will not be made.
8. ( ) A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. (X) An unexecuted oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ( ) A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern document(s) or information included:**

11. ( ) An information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ( ) An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ( ) A FIRST preliminary amendment.
    ( ) A SECOND or SUBSEQUENT preliminary amendment.
14. ( ) A substitute specification.
15. ( ) A change of power of attorney and/or address letter.
16. (X) Other items of information.
    (X) Copy of PCT Request Form.
    (X) Copy of PCT Demand.
    (X) Copy of International Preliminary Examination.
    (X) Copy of Form PCT/IB/308 (Notice Informing Applicant of the Communication of the International Application to the Designated Offices).

Certificate of Express Mail

I hereby certify that the foregoing documents are being deposited with the United States Postal Service as Express Mail, postage prepaid, "Post Office to Addressee", in an envelope addressed to the Assistant Commissioner for Patents, Box PCT, Attn: DO/EO/US, Washington, D.C. 20231 on the date indicated below.

Jonathan Furtado

Express Mail Label: EL408064135US
Date of Deposit: March 31, 2000

| U.S. APPLICATION NO (if known, see 37 CFR 1.5) | INTERNATIONAL APPLICATION NO | ATTORNEY'S DOCKET NUMBER |
|---|---|---|
| 09/509732 | PCT/IL98/00453 | LLE-004.01 |

17. (x) The following fees are submitted:

| BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): | CALCULATIONS PTO USE ONLY |
|---|---|
| Search Report has been prepared by the EPO or JPO ..... 840.00 | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... 670.00 | |
| No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... 760.00 | |
| Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... 970.00 | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $96.00 | |
| **ENTER APPROPRIATE BASIC FEE AMOUNT =** | $ 970.00 |

| | | | | |
|---|---|---|---|---|
| Surcharge of **$130.00** for furnishing the oath or declaration later than ( ) 20 ( ) 30 months from the earliest claimed priority date (37 CFR 1.492(e)). | | | | $0 |
| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | |
| Total claims | 20 - 20 = | | X $18.00 | $ |
| Independent claims | 2 - 3 = | 3 | X $78.00 | $ |
| MULTIPLE DEPENDENT CLAIM(S) (if applicable) | | | + $260.00 | $ 260.00 |
| | **TOTAL OF ABOVE CALCULATIONS =** | | | $1230.00 |
| Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28). | | | | $ |
| | | | **SUBTOTAL =** | $1230.00 |
| Processing fee of **$130.00** for furnishing the English translation later than ( ) 20 ( ) 30 months from the earliest claimed priority date (37 CFR 1.492(f)). | | | + | $0 |
| | | | **TOTAL NATIONAL FEE =** | $1230.00 |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property. | | | + | $0 |
| | | | **TOTAL FEES ENCLOSED =** | $1230.00 |
| | | | Amount to be: refunded | $ |
| | | | charged | $ |

a. ( X) A check in the amount of $1230.00 to cover the above fees is enclosed.

b. ( ) Please charge my Deposit Account No **06-1448** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. (X) The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **06-1448, Ref. LLE-004.01.** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

Patent Group
Foley, Hoag & Eliot LLP
One Post Office Square
Boston, MA 02109-2170

SIGNATURE

Chinh H. Pham
REGISTRATION NO. 39,329

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS**
**(37 CFR 1.9(f) & 1.27(c))--SMALL BUSINESS CONCERN** Docket No.: **LLE-004.01**

Applicant or Patentee: David ITZHAK
Serial or Patent No.: To Be Determined
Filed or Issued: Concurrently Herewith
Title: WATER TREATMENT METHOD AND DEVICE

I hereby declare that I am

( ) the owner of the small business concern identified below:

(X) an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN Argad Water Treatment Industries, Ltd.
ADDRESS OF SMALL BUSINESS CONCERN P.O. Box 7
30300 Atlit, Israel

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

(X) the specification filed herewith with title as listed above.
( ) the application identified above.
( ) the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention must file separate verified statements averring to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern with would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization having any rights in the invention is listed below:

(X) no such person, concern, or organization exists.
( ) each such person, concern or organization is listed below.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Shevach Nudelman

TITLE OF PERSON IF OTHER THAN OWNER V.P.O M.O

# WATER TREATMENT METHOD AND DEVICE

## Field of the Invention

The present invention relates to water treating systems, particularly to scale removing and biocidal water treating systems.

## Background of the Invention

The problem of scale is inherent to all systems in which there is a flow of water that contains any of $Ca^{++}$ and $Mg^{++}$ ions together with any of $OH^-$, $CO_3^=$, $HCO_3^-$, $SiO_3^=$, or $SO_4^=$. Under certain temperature and pH conditions, carbonates, silicates, sulfates and hydroxide salts precipitate and cause blockage of nozzles, reduction of cross-section area of pipes, heat insulation and underdeposit corrosion. The well-known methods of removing scale from aqueous liquids are reverse osmosis and ion exchange. Another method for removing scale is direct current (DC) electrolysis. US 4,384,943 discloses a method of fluid treatment which comprises applying DC current to aqueous liquids.

Electrolytic treatment of aqueous fluids to produce biocides is well known in the art. For example, US 4,384,943 describes such a treatment which comprises maintaining in the fluid a compound that is electrochemically decomposable to yield bromine, chlorine or iodine and/or by decomposing water to produce biocidally active $O_2$ or $O_3$ oxidants.

US 5,424,032 describes a method of treating water using innocuous chemicals for the treatment of microorganisms, or employing ultraviolet light or electrolysis in order to destroy microorganisms.

The term "disinfecting", as used herein, means destroying various types of microorganisms to the extent that this prevents the formation of biological fouling, and disinfection of drinking water or of water for use in bathing.

Since scale removing and scale preventing are related processes, each of the terms "scale removing" and "scale preventing" herein mean both scale removing and scale preventing.

It is a purpose of the present invention to provide a process for preventing or at least inhibiting the growth of microorganisms in aqueous solutions, e.g., water, and for precipitating scale therefrom, which does not require the addition of chemicals to said solutions, and thus is an environmentally-friendly process. Thus, the invention solves many severe problems inherent to prior art methods. For instance, there are cooling systems in which the water is treated by the addition of chemicals. The bleed stream of such cooling systems cannot be used in many applications, due to the presence of said chemicals, and in many cases said bleed stream is wasted or requires expensive purification treatments to remove the chemicals, before it can be released into the environment.

It is another purpose of the present invention to provide a process for disinfecting aqueous liquids and for removing scale therefrom which permits to operate at a pH higher than 7, and even higher than 8.5.

It has now been found, and this is still another object of the invention, that in a system where a DC treatment having a combined effect of *in situ* production of biocides and of scale precipitation was applied to an aqueous fluid, e.g., pure water with no further additives, a dramatically lower percentage of scale was required to be precipitated than described in the prior art, in order to achieve substantially the same results of disinfecting and scale removing, as achieved for softened water described in the prior art.

**Summary of the Invention**

The present invention provides a method of treatment of aqueous media, comprising applying to said aqueous medium in an electrolytic cell an electrical direct current of a magnitude and at a flow-rate of the liquid in said electrolytic cell such that a combined effect of scale removing and disinfecting is achieved.

The present invention further provides an aqueous fluid treatment device for scale removing and disinfecting comprising an electrolytic cell operated by a direct current source, said electrolytic cell being adapted to allow an aqueous medium to circulate therethrough.

The amount of direct current applied to said aqueous fluids varies according to the type of aqueous medium. For example, in the case of the treatment of cooling water, the preferred amount of direct current applied thereto is about $1A/5m^3$/hour.

Aqueous media that can be treated include, but are not limited to, drinking water, tap water, agriculture water, industrial water, sea water and sewage water. An advantage

of the present invention is that the pH at which it is possible to operate is not limited, so that it is possible to operate at a pH much higher than the prior art. As will be apparent to the skilled person, at pH of about 8-9 no corrosion inhibitors are required, because of the basic nature of the water, and this is another substantial advantage of the invention.

The device of the present invention can be used in any watering system, cooling system, heating system, water supplying system, and fogger. Said watering systems is can include, but are not limited to, drippers, sprinklers and foggers. Cooling systems include, e.g., cooling towers. Heating systems include, e.g., kettles, boilers, washing machines, dishwashers, quick water heaters, evaporators, radiators, steam generators, steam irons, steam cleaners, module water heaters, heating boosters, thermal convectors, greenhouse heaters, and central heating systems. Heating systems may further include, e.g., showers, sinks, bidets, bathtubs, hot tubs such as Jacuzzi-type tubs and whirlpools, spas and swimming pools.

Optionally, the aqueous medium can further be filtered, and thus the device of the present invention optionally further comprises, in case said device includes a liquid outlet, a filter connected to said outlet, through which the electrically treated aqueous fluid is driven.

**Brief Description of the Drawing**

- Fig. 1 schematically shows a water treatment device according to a preferred embodiment of the invention.

**Detailed Description of Preferred Embodiments**

The present invention provides a method of treating aqueous solutions, which achieves a combined effect of scale removing and disinfecting. Such a method can meet the need of many systems in which both effects are required, such as agricultural systems in which water is distributed through narrow nozzles of sprinklers, drippers and foggers, and even a small quantity of scale and/or biofilm is liable to cause a blockage of said nozzles.

A treatment according to the present invention can be carried out, e.g., by a unit which comprises a liquid container having at least one liquid inlet and one liquid outlet, e.g., a pipe, further comprising at least one cathode and one anode placed within said liquid container, said cathode and anode being in electrical contact with the "-" and "+" poles of a direct current source, respectively. Said liquid inlet is connected to a water source, and said liquid outlet is connected to a target system, e.g., sprinklers, drippers and foggers, in which the disinfected, scale removed water is desired.

Furthermore, as stated above, the present invention is suitable for disinfecting liquids and for removing scale therefrom, in systems in which it is required to maintain a pH in the range 7 - 10. In the process of the invention, the pH changes only locally, near the electrodes, whereas in other systems, in which chemicals are added, the pH changes homogeneously, and may cause severe operational problems, such as corrosion.

As will be further discussed hereinafter, when the invention is applied to the treatment of cooling water no chemicals are added and therefore the bleed stream can be used in a wide range of applications, e.g., crops watering. Furthermore, as will be further illustrated in the examples to follow, the invention permits to employ water having a conductivity of 3,000 μS or higher, up to about 6,000 μS, without causing any substantial increase in corrosion. A typical pH for operating under these conditions is pH ≈ 9. In this specification "μS" indicates the μSiemens unit (which equals $\mu\Omega^{-1}$). This result is both unexpected and remarkable, particularly since current standards, in cooling towers employing chemicals, is not greater than 3,000 μS, and often as low as 2,000 μS. The ability of allowing high conductivities, while preventing biofouling and scale formation, practically means that a smaller bleed – and consequently a smaller make-up of water – is needed in the operation of the cooling tower. Thus, when operating according to the invention, a reduction of up to about 30% in the make-up can be achieved, as well as a reduction of up to about 60% of the bleed, thus leading to a substantial saving in water usage and waste disposal.

The present invention can be carried out by means of any electrolytic cell. An example of such a cell is described, e.g., in Whitten et al., "General Chemistry with Qualitative Analysis", *Saunders College Publishing*, 4th ed., pp. 12-13.

It should be understood that the two processes that take place simultaneously (biocidal effect and scale prevention or removal) each require different, sometime contrasting operating conditions. Thus, in order to obtain a biocidal effect it is required to operate with high currents (the production rate of biocidal species in the

water is a function of the current) and high water flow-rates. On the other hand, in order to achieve a substantial anti-scale effect low water flow-rates are needed, while the magnitude of the current is of no consequence. It should further be noted that pH and precipitation conditions are much more severe at the electrodes than on the surfaces of the water apparatus.

Accordingly, preferred illustrative – but non-limitative – operating conditions are as follows:

The current required to obtain a substantial biocidal effect depends on the type of water treated and on the oxidant demand of the water. This can be estimated as:

$$1\ A = 1\ gr\ O_x/hr$$

wherein $O_x$ is a $gr_{(eq)}$ of a monoelectronic oxidant such as Cl*, OH*, ½O* or Br*.

In order to obtain a substantial biocidal effect in a typical water, it is required to provide a detectable residual amount – e.g., about 0.05 ppm, of active chlorine equivalent. The active chlorine equivalent present in the water can be determined using conventional methods, e.g., using the Chlor-Test kit manufactured by Merck KgaA, Germany, or the Lovibond kit manufactured by The Tintometer Ltd., UK, or by any other suitable method.

In order to obtain a substantial anti-scale effect, the linear flow velocity of water in the electrolytic cell (calculated as the flow rate divided by the cross section of the cell) should not exceed 500 m/hr, and should preferably be 100 m/hr or lower.

According to a particular embodiment, the invention is exploited in a Jacuzzi-type (whirlpool) hot tub or spa. In such environments there is a further important parameter, which is the turbidity of the water. A normal turbidity for clear water should not exceed 0.8 NTU (normal turbidity units). According to a preferred embodiment of the invention a whirlpool bath should operate with a current density of at least 1 $A/m^3$, in order to achieve normal turbidity and at the same time to avoid scaling effects and biofouling.

A water treatment device according to the present invention can be in a form such as that illustrated in Fig. 1, in which numeral 1 is a pipe, numeral 2 is a rectangular anode, and 3 and 4 each are rectangular cathodes (cathode boards). Anode 2 is positioned along the longitudinal axis of pipe 1. Cathode boards 3 and 4 are positioned along the longitudinal axis of pipe 1, one on each side of anode board 2 and both cathodes face anode 2. According to an alternative embodiment of the invention (not shown in the figure), pipe 1, made of metallic material may, by itself, function as the cathode, instead of cathodes 3 and 4, or in addition.

In the examples to follow a device essentially as described in Fig. 1 was employed, having the following dimensions: pipe 1 was a plastic pipe 60 inches long and having a diameter of 10 inches, the anode was a rectangular board made of titanium, coated with a catalytic coating and the two cathodes were each rectangular boards made of

steel. All three electrodes were each 50 inches long and 5 inches wide. The distance between each of the cathodes and the anode was 3 inches. Of course, the above dimensions will vary in different arrangements and shapes of the device, and they are provided herein for the purpose of exemplification only, and are in no way meant to limit the invention.

**Example 1 (comparative)**

A stream of non-treated water was used in a fog-generator used in a greenhouse, in which tomatoes were cultivated, for the purpose of cooling and keeping the temperature at a fixed level of about 25-30°C. Due to the precipitation of scale and the growth of microorganisms and algae around the nozzle, a blockage occurred at the nozzle and the nozzles had to be replaced. The average lifetime of nozzles in such system was 3 to 4 days.

**Example 2 (comparative)**

A stream of water treated by reverse osmosis was used in the same system as in Example 1. The average lifetime of the nozzles, in this case, was 1 to 2 months.

**Example 3**

A stream of water treated by DC current according to the present invention was used in the same system as that of Example 1. After three months there were no blockages registered in any of the approximately 1000 nozzles, and the upkeep of said nozzles was spared. Due to the use of the direct current treatment device of the invention, the water was disinfected and scale was removed therefrom to the extent that the

problem of blockages was solved for all practical purposes. Furthermore, the water was free from chemical additives and was suitable for a wide range of uses. Tomatoes that were watered with the treated water showed no decay of growth. These results show a substantial improvement over the systems of Examples 1 and 2.

**Example 4 (comparative)**

A stream of non-treated water was used in a cooling tower operating at a flow rate of 500 $m^3$/hr, with a make-up of 30 $m^3$/hr, and a bleed of 10 $m^3$/hr. The conductivity of the tap water was about 1,000 μS, and that of the bleed stream (and, hence, of the recirculating water) was 3,000 μS. After two weeks, a substantial layer of biofilm and scale was observed on the walls of the tower. The water in the tower was turbid.

**Example 5 (comparative)**

A stream of water treated by polyphosphonates, sulfuric acid and corrosion inhibitors at a pH of less than 8 was used in the cooling tower of Example 4. As a result, the pH was unstable and scale and biofilm appeared on the walls of the tower, and were removed every three months in order to allow a smooth functioning of the tower. Metallic elements showed some corrosion. The water in the tower was turbid, and was not suitable for watering processes.

**Example 6**

A stream of water of with a recirculation stream of 50 $m^3$/hr treated by DC current according to the present invention was used in the system of Example 4 at the time that a layer of biofilm, as well as scale, were already present. The conductivity of the

bleed stream was 5,000 μS. The pH was 8.8. The make-up was 20 $m^3$/hr and the bleed 4 $m^3$/hr. After two weeks, said layer disappeared, and the water in the tower was clear. No corrosion was noted. The bleed flow was of a quality suitable for watering processes. Due to the use of the direct current treatment device of the invention, the water was disinfected to the extent that not only did further biofilm not appear on the walls of the tower, but the existing biofilm vanished. The clear water, scale and biofilm removal, and the "green" use of the bleed flow of the present example show a substantial improvement over the results of Examples 4 and 5.

**Example 7**

A 2 $m^3$ Jacuzzi-type hot-tub was used for this example. The turbidity in the water was 0.5 NTU. The whirlpool was operated for 4 consecutive hours with 4 persons bathing each during 1 hour, without the addition of any chemicals. The turbidity at the end of this 4-hour period was 3 NTU. The whirlpool was then operated empty, together with an electrolytic cell treating water with a maximal recycle ratio of 6/hr (number of volumes recirculated per hour), at 10A for 2 hours, at the end of which period the turbidity was 0.1 NTU. The redox potential was 600 mV. The make-up of water to the tub was effected on demand by a level indicator that controlled the level of water in the tub.

The experiment was repeated daily during two weeks, without any water replacement, and the turbidity dropped each time to the same value of 0.1 NTU.

Additionally, the redox potential of the water was measured about 3 hours after the bathing, and was found consistently to be in the range 500 – 700 mV, with a detectable amount of oxidants. Furthermore, during this experiment 150 gr of scale were removed from 2 $m^3$ of water, containing mainly $CaCO_3$ and $Mg(OH)_2$.

A comparative test was also run with currents below 2A, and it was found that below this value it was not possible to reach a redox potential greater than 500 mV. The turbidity of the water, however, still remained at a suitable level (0.1 NTU).

As will be apparent to the skilled person, the above results are greatly advantageous for use in bathing systems, such as whirlpool. It should further be noted that the control of the turbidity is of great importance, since it is undesirable to replace the water in the whirlpool, because fresh water carries with it added amounts of carbonates which cause the clogging of orifices.

The above description and examples have been provided for illustrative purposes only, and are not intended to limit the invention in any way. It will be apparent to the skilled person that many modifications, variations and adaptations may be made to the invention by persons skilled in the art, without departing from the spirit of the invention or exceeding the scope of the claims.

CLAIMS:

1. A method of treatment of aqueous media comprising applying to said aqueous medium in an electrolytic cell an electrical direct current of a magnitude and at a flow-rate of the liquid in said electrolytic cell such that a combined effect of scale removing and disinfecting is achieved.

2. A method according to claim 1, wherein the current is such as to generate detectable residual amount of active chlorine equivalent in the water.

3. A method according to claim 2, wherein the residual amount of active chlorine equivalent in the water is 0.05 ppm or higher.

4. A method according to any one of claims 1 to 3, wherein the linear flow-rate of aqueous medium through the electrolytic cell is 500 m/hr or less, preferably 100 m/hr or less.

5. A method according to any one of claims 1 to 4, wherein the aqueous medium is water from a whirlpool, the current density is at least 1 $A/m^3$.

6. A method according to any one of claims 1 to 4, wherein the aqueous medium is water from a cooling tower, and the conductivity in the recirculating water is between 3,000 μS and 6,000 μS.

7. A method according to any one of claims 1 to 4, wherein the aqueous medium is selected from a group which consists of tap water, agricultural water, industrial water, sea water and sewage water.

8. A method according to any one of claims 1 to 7, wherein the pH of the water is maintained at a value above 7.

9. A method according to claim 8, wherein the pH is in the range 8 – 9.

10. An aqueous fluid treatment device for scale removing and disinfecting comprising an electrolytic cell operated by a direct current source, said electrolytic cell being adapted to allow an aqueous medium to circulate therethrough.

11. An aqueous fluid treatment device according to claim 8, for use in agriculture watering systems.

12. A device according to claim 11 wherein the watering systems are selected from the group which consists of drippers, sprinklers and foggers.

13. An aqueous medium treatment device according to claim 10, for use in a cooling system.

14. A device according to claim 13, wherein said cooling system is a cooling tower.

15. An aqueous medium treatment device according to claim 10, for use in a heating system.

16. A device according to claim 15, wherein said heating system is selected from the group consisting of kettles, boilers, washing machines, dishwashers, quick water heaters, evaporators, radiators, steam generators, steam irons, steam cleaners, module water heaters, heating boosters, thermal convectors, greenhouse heaters, and central heating systems.

17. An aqueous medium treatment device according to claim 10, for use in a water supplying system.

18. A device according to claim 15, wherein said heating system is selected from the group that consists of showers, sinks, bidets, bathtubs, hot tubs, particularly Jacuzzi-type tubs and whirlpools, spas and swimming pools.

19. An aqueous medium treatment device according to claim 10, for use in a fogger.

20. A cooling tower system comprising:

- a cooling tower; and
- a device according to claim 10;

said cooling tower being adapted to bleed water and to receive make-up water when the conductivity of said water is in the range 3,000 μS – 6,000 μS.

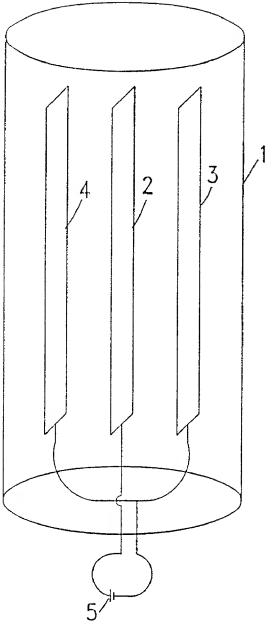


Fig. 1

**DECLARATION FOR PATENT APPLICATION** Docket Number: **LLE-004.01**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

*Water Treatment Method and Device*

the specification of which (check one): ( ) is attached hereto.
(X) was filed on 17 September 1998 as International Application Application Number **PCT/IL98/00453**, and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulation, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

| Prior Foreign Application(s) | | | Priority Claimed |
|---|---|---|---|
| 121880 (Number) | Israel (Country) | October 1, 1997 (Day/Month/Year Filed) | (X) Yes ( ) No |
| PCT/IL98/00453 (Number) | PCT (Country) | September 17, 1998 (Day/Month/Year Filed) | (X) Yes ( ) No |

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States Provisional application(s) listed below.

_____ _____
(Application Number) (Filing Date)

_____ _____
(Application Number) (Filing Date)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

| (Application Number) | (Filing Date) | (Status: patent, pending, abandoned) |
|---|---|---|
| (Application Number) | (Filing Date) | (Status: patent, pending, abandoned) |

I hereby appoint Chinh H. Pham, Reg. No. 39,329; Beth E. Arnold, Reg. No. 35,430; Charles H. Cella, Reg. No. 38,099; Isabelle M. Clauss, Reg. *(see attached)*; Kirk Damman, Reg. No. 42,461; Dana Gordon, Reg. No. 44,719; David P. Halstead, Reg. No. 44,735; Robert A. Mazzarese, Reg. No. 42,852; Edward J. Kelly, Reg. No. 38,936; Wolfgang E. Stutius, Reg. No. 40,256; Matthew P. Vincent, Reg. No. 36,709; and Anita Varma, Reg. No. 43,221 as attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor (given name, family name): David ITZHAK

| | |
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